Carnarvon based SARAO staff and students perceptions of the NRF|SARAO’s Human Capacity Development in the Northern Cape, South Africa

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**Abstract**: *The Karoo Region in the Northern Cape Province, South Africa was identified as a site to establish a large section of the Square Kilometer Array (SKA) which will feature the world’s largest Radio telescope, a project being spearheaded by the NRF|SARAO through the construction of The MeerKAT Radio telescope that will be integrated in the SKA. Owing to the documented shortage of skilled workforce particularly in the field linked to the SKA project, the NRF|SARAO has a role to play in developing skills in the Northern Region in line with the Skills Development Act No. 97 of 1998 to promote productivity and national development. This study explores the human capacity development (HCD) programs offered by the NRF|SARAO and surveyed 17 participants to document their perceptions towards the HCD programs. Respondents acknowledged the HCD programs being offered by the NRF|SARAO to train them and become involved in the SKA project. Various hindrances that affects the success of the HCD programs were raised which have to do with both the respondents themselves and their perceptions, as well as the standards that are set by the NRF|SARAO which at times hinder the potential candidates to take up the programs. Respondents’ had varied views towards the effectiveness of the NRF|SARAO programs which varied between highly effective to not effective at all.*

Keywords: livelihood, project, socioeconomic, technology, telescope

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1. Introduction

The Square Kilometer Array (SKA) project is a global endeavour to build the largest radio telescope in the world and making it one of the most ambitious investments of the new millennium (Chinigò & Walker, 2020:396). The telescope will ultimately be the largest both in physical scale as well as in terms of the voluminous data it will generate (Berry, 2020). Among the countries that bid to host the SKA project, Australia and the Republic of South Africa (RSA) were identified as the finalists and subsequently named as cohosts for the SKA project, and SKA South Africa came into existence (Binneman & Davis, 2020:3; Binneman & Davis, 2021:223). Once the SKA project is completed, it will consist of thousands of radio telescopes that are spread across a collecting area of 1 km2 (SKA SA, 2016; Isaacs, 2016). At present, infrastructural hubs for the SKA are located in the semi-arid Nama Karoo region of South Africa in the Northern Cape Province, approximately 90 km from a small town of Carnarvon; and in Murchison Shire in Western Australia; with additional satellite dishes reaching into other African countries (Botswana, Namibia, Mozambique, Zambia, Mauritius, Madagascar, and Ghana) (SKA SA, 2016; Isaacs, 2016; Binneman & Davis, 2020:4).

In South Africa, the Karoo was chosen as site for the project because it is sparsely populated, remote, protected, and generally dry in terms of climate (Binneman & Davis, 2021:223). Further to these, area has minimal radio frequency interference from mobile phones, broadcast transmitters, GPS satellites, air traffic and WIFI, which is crucial for radio astronomy (SKA SA, 2016; Isaacs, 2016; Binneman & Davies, 2020:3; Binneman & Davis, 2021:223). At present, the National Research Foundation|South African Radio Astronomy Observatory (NRF|SARAO) spearheads SKA engineering, science, and construction activities in South Africa. In addition, NRF|SARAO incorporates radio astronomy instruments as well as programs such as the KAT-7 and MeerKAT telescopes in the Karoo region, the African Very Long Baseline Interferometry program situated in 9 African countries, and the human capacity development and commercialization endeavours that support these projects (Binneman & Davis, 2021:224).

Human capacity development (HCD) is defined by the United Nations (UN) as “the process of developing and strengthening skills, abilities, instincts, resources and processes and that communities and organisations need to survive, adapt, and thrive in a fast-changing world. An essential ingredient in capacity development or building is transformation and the UN through its Sustainable Development Goal 17 is committed to capacity building. Human capacity development in organizations creates a significant contribution on organisational competencies which in turn enhances innovativeness and overall firm performance. Capacity development programmes are mandated by South Africa’s Skills Development Act No. 97 of 1998 that suggests organisational frameworks accommodating workplace programmes, policies and strategies (Machika, 2014). These strategies need to be aligned with the qualification criteria and framework of South Africa (Machika, 2014). Human capacity development strengthens organisations and their facilities, and also concentrates on the conditions that permit staff to engage in transformation processes (Utete, 2021). Human capacity development is however, viewed as an endogenous dynamic phenomenon which depends greatly on the perseverance, effort and motivation of an individual to progress and learn (Utete, 2021).

Under the Skills Development Act No. 9, the NRF|SARAO has a role to play so as to enhance its operations as well as to develop the communities of the Karoo and South Africa as a whole. This is clearly stated on the NRF website that it is “mandated to support and promote research through funding, human resource development and the provision of the necessary research facilities in order to facilitate the creation of knowledge, innovation and development in all ﬁelds of science and technology, including indigenous knowledge, and thereby contribute to the improvement of the quality of life of all South Africans”. The communities living in Karoo small towns are characterised by poor socioeconomic conditions, extremely high unemployment and high school dropout rates (van der Hoef, 2017). These communities are now being exposed to a multi-billion Rand, cutting-edge science project. It is difficult to overlook the paradox in this situation or ignoring the tensions this juxtaposition has created within the local communities. The SKA project is bound to receive various perceptions with regards to its HCD progress, besides its national and global goals. Understanding the perceptions of the people linked to the NRF|SARAO perceptions reflects on the progress made by the NRF|SARAO with regards to fulfilling its mandates of HCD in line with supporting communities and the SKA project itself. This study therefore aims to assess the perceptions of the people linked to the NRF|SARAO towards HCD programs availed by the NRF|SARAO to increase their chances of being part of the skilled labour for the SKA project.

* 1. Problem statement

Human capacity development is regarded as a costly investment offering long-run rich financial benefits for the supporting organisation and its importance should be accepted at all levels (Khan and Khan, 2010). Firms and organisations must pay particular attention to programmes that are involved in HCD programmes as these not only build the capacity of human resources, but also strengthen productivity of the organisation. With the NRF|SARAO spearheading the SKA project in the Northern Cape, HCD should be evident through skills development of people linked to the project. This overall, aids to the pool of skilled workers in South Africa, as skills shortages were named as the 8th biggest risk in the country (van Rensburg, 2020; Business Tech, 2022). Among the affected skills are mostly in the field of engineering and technology, a field which is a centre of the SKA project. This study hence determines the perceptions of the people linked to the NRF|SARAO towards HCD.

* 1. Significance of the study

Human capital is an important resource and hence, investment in its development is critical for the success of any organisation to maximize production and accelerate economic growth. The justification of this study comes from an increasing interest in HCD around the world in general and in RSA in particular. Human capacity development in organisations is supported by the Skills Development Act No. 9. It is therefore of interest to evaluate how the NRF|SARAO supports the Act during the implementation of SKA project to in line with the national goals. This study also helps to fill the knowledge gap in the literature with regards to the perception of HCD in South Africa as it contributes to knowledge by providing the perceptions of the NRF|SARAO about their investment in HCD. The extent to which the NRF|SARAO invests in HCD to some extent, will give either a positive or negative reflection of the SKA project.

1. Literature review

This review describes in detail, information about the SKA project. It also looks at some of the findings revealed by other researchers that looked at projects that were established in various regions and how they established relationships with resident communities and how their findings might be integrated and developed in this research investigation.

* 1. The SKA project

The purpose of the SKA project is to understand how the universe evolved, how the galaxies and stars form and change (SKA-SA, 2016). This project is predicted to create a “long baseline interferometer array, where all instruments will act as a single dish in order to expand the mapping range of the observable universe that could potentially answer some profound questions in the field of cosmology and astrophysics (Binneman & Davis, 2021:224). According to the scientists involved in the project, the SKA will be able to make some new discoveries that will go beyond what we can currently imagine and may even discover life elsewhere in the universe (SKA-SA, 2016). This mega-science project requires, development of one of the finest technologies, including designing the fastest supercomputers and fibre optic lines in the world to process the immense amounts of data produced by the telescope. The SKA project will consist of thousands of radio antennas that are able to detect even the weakest radio signals from outer space, which will enable the astronomers to analyse the universe in exceptional detail (SKA-SA, 2016).

The antennas are highly sensitive and the developers of the SKA project stressed the importance of the telescopes to be located in a thinly populated area, and as far away as possible from any machines and electronics that can interfere with radio waves coming from the universe (SKA-SA, 2016). Other important factors that were considered were that core sites should be built on a dry, elevated area, to prevent waves being absorbed by atmospheric moisture. For these reasons, the Great Karoo area between the towns of Brandvlei, Carnarvon, Vanwyksvlei and Williston was identified as being the perfect building site for the SKA project and in 2014 the South African government declared the area around the SKA core site, a ‘Central Astronomy Advantage Area’ in terms of the 2007 Astronomy Geographic Advantage Act (Act No. 21 of 2007) (Department of Science and Technology, 2014).

* 1. The SKA and local community development

Since the completion of the KAT-7 in December 2010, the SKA has initiated several local development projects in the Kareeberg area. Although the main goal of the SKA project is to establish the most advanced radio telescope in the world, its senior management has identified local community development as an important objective, for example, by improving education, communication and driving local businesses (SKA-SA, 2015). The socioeconomic conditions of the Northern Cape Province already made it evident how urgently needed development projects for the local community are in this area. The statistics on education levels, poverty levels and unemployment rates all underline the urgent need for development initiatives which concentrates on education and information technology access. When the idea of the SKA project was first introduced to the communities in the Northern Cape in 2008, SKA officials claimed that the project would lead to job creation, local economic development and improved opportunities for the youths through the promotion of science and education (Wild, 2016). These sentiments were also emphasised by the SKA management (van der Hoef, 2017).

* 1. HCD in South Africa

Human capacity development has many meanings and interpretations which vary according to the context in which it is being used in (Utete, 2020). For the purpose of this study, the definition by UN which defines HCD as, “the process through which individuals, organizations and societies obtain, strengthen and maintain the capabilities to set and achieve their own development objectives over time.”, is used. The Skills Development Act of South Africa (Act No. 97 of 1998) is in line with the National Skills Development Strategy (NSDS). The NSDS decentralises this strategy to each Sector Education and Training Authority (SETA) meeting the skills requirements of each sector. The government of South Africa recognised the significant roles as well as contribution of skilled, semi-skilled and knowledge-based labour that can potentially offer quality public services (Mohapi, 2011: 3).

Human capacity development is regarded as an instrumental tool for every firm or organization to develop and fulfil its visions and missions. Human capacity development programmes include the following:

1. *Training*

This is the most important tool used to develop the skills and capacity of organisations. Training opportunities should be fairly availed to all the staff members at every level and it is the responsibility of every firm or organization to develop the workplace skills plans. Training may take the form of workshops, courses, capacity building programmes and other development programmes. An effective training can be adapted in order to achieve the strategy of an organisation. Training can also provide the skills and knowledge required to cope with new responsibilities, new working practices and standard operating procedures.

1. *Internships and Learnerships*

These are measures that organisations can use in order to develop and improve their capacity.

1. ***Legislative requirements***

Legislative requirements for capacity building must be also taken into consideration. The government in South Africa being faced by the challenge of highly skilled labour, is compelled to spearhead developing policies supportive of the socioeconomic changes and challenges currently being faced by the country is facing. In this regard legislation that support HCD have been put in place.

* 1. Other global projects

Across the globe, several socioeconomic, environmental and political dimensions are shaping the functionality, fortunes and relevance of communities at the basic level of human society (Mensah & Okyere, 2014). Development project inception is a phenomenon often marked by a political grandstanding with emphasis placed on the need for trade-offs between meeting the national socioeconomic developmental targets and debt servicing rather than on welfare of the impacted communities (Madebwe et al., 2011). Globally, various projects have been introduced onto the doorsteps of various communities just like the SKA. Similarly, these have received various reactions from the resident communities and for them to establish well, they have to carry various benefits to give back to the resident communities (Madebwe et al., 2011). The problems involved in the interrelations of projects and communities have been explored by many researchers (Madebwe et al., 2011; Mensah & Okyere, 2014; Tang-Lee 2016). Literature on how these have invested in HCD is however scant. Much literature is available on the impacts of the projects on social livelihoods of the communities (World Commission on Dams, 2000; Lassey, 2002; Terminski, 2012; Mensah & Okyere, 2014). These examples imply that developmental projects often affect the livelihoods of resident communities and hence, the responsible organisations should ensure that the process of acquiring the land transitions smoothly without any aftermath conflicts.

The responsible organisations should ensure that the project empowers the communities through various programs which is one of the objectives of this study. What skills and manpower development programs have been availed by the NRF|SARAO and how has the staff benefited from the programs. In providing skills and manpower development programs, the NRF|SARAO contributes to the scarce skills not only in the Northern Cape Province, but in the entire Republic as constraints of genuine skills is generally affecting the productivity of labour and hampering the ability to innovate as well as to adopt new technological developments (Brunello and Wruuck, 2021:1145). Shortage of highly skilled labour is a global phenomenon and countries continuously express their unhappiness regarding shortages of skilled professionals in various important sectors of their economic activities (Mateus et al., 2014:63). For individuals, not having the rightful skills limits employability prospects and their access to quality jobs (Brunello & Wruuck, 2021:1145). While there is sufficient labour to support other manual jobs for example, farming activities, skill requirement to support technology project are acutely in short supply. It can be assumed that soft management skill may be needed but the supply of Science, Technology, Engineering and Mathematical (STEM) skills are very low. A strategy to develop and supply such skill may not necessarily be the core function of the NRF|SARAO but they can certainly make some contribution for the success of the project. Technological change is a major factor which induces sectoral dynamics: with some sectors gaining employment and others shrinking; and changing the demand for skills within firms and occupations (Brunello & Wruuck, 2021:1147).

1. Research design and methodology
   1. Study area

The was conducted in the Karoo area, Northern Cape Province of South Africa (Fig. 3.1). The core site of the SKA is located in the Meerkat National Park in the Karoo area. The Northern Cape is the country’s largest province taking up a third of the country’s total land area. While it is the largest province in the country, it is the most sparsely populated, with only about 2.3% of the population living in small towns found there.

* 1. Sampling

This research utilized a descriptive research approach so as to collect and interpret the data collected to understand the interplay of collected data in relation to the investigated problem. The study comprised of 17 participants from the Karoo area linked to the SARAO HCD program. A semi-structure questionnaire was used to conduct this study with questions based on the study objectives (see Supplementary material). The process of interviewing was conducted in an organized and consistent manner by arranging appointments with individual participants, each for a different date and time. Interviews were flexible to respondents work commitments to allow them to engage in in-depth regarding discussions relating to the skills development questions. This practice was employed to acknowledge the fact that every interviewee has a different background and, thus, a unique experience of the skills development topic. In this study, the interviewees were encouraged to ask for explanations when issues raised in the questions were unclear.

**Figure 3.1. Map of South Africa showing the location of SKA**

* 1. Ethical considerations

This study was given ethics clearance by the Faculty’s Research Ethics Committee (FREC) of the Cape Peninsula University of Technology (ethics approval no. 2020FBREC825). Study processes and ethical issues were addressed which included participation consent, anonymity, confidentiality and withdrawal of the respondents. Participants were assured that the information they gave would be treated with privacy and was solely for study purpose. For consent, the participants were requested to sign a consent form indicating their willingness to participate in the study.

* 1. Data analysis

The questionnaires were sorted, coded and entered into Microsoft Excel. The data were imported into the Statistical Package for Social Sciences (SPSS) software where data analysis was conducted.

1. Results and Discussions
   1. Development that can be done in the Karoo

According to the findings in Table 4.1, the respondents expect the NRF|SARAO to create or give more working opportunities as shown by the high percentage of 47.1% as compared to other responses. Other responses included: accommodation provision in cities, building of colleges, equipping farmers and farmworkers, and provision of bursaries; which had least responses of less than 6% each.

Table 4.1: Development the Karoo and make the skills development programs effective?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Frequency | Percent | Valid Percent | Cumulative Percent |
| Accommodation in cities | 1 | 5.9 | 5.9 | 5.9 |
| Broaden skills development fields | 1 | 5.9 | 5.9 | 11.8 |
| Build a FVET college in Carnarvon | 1 | 5.9 | 5.9 | 17.7 |
| Create or give more working opportunities | 8 | 47.1 | 47.1 | 64.7 |
| Equip farmers and farmworker | 2 | 11.8 | 11.8 | 76.5 |
| Get a bigger training centre | 1 | 5.9 | 5.9 | 82.4 |
| More options in the bursary programs, give school bursaries not only based in Carnarvon. | 1 | 5.9 | 5.9 | 88.3 |
| None | 2 | 11.8 | 11.8 | 100.0 |
| Total | 17 | 100.0 | 100.0 |  |

* 1. What type of skills does NRF|SARAO need in the Karoo?

Table 4.2 shows the type of skills the NRF|SARAO could need in the Karoo as perceived by the respondents. The artisans and engineering trades were mentioned the most with a percentage of 52.9% followed by office workers with a percentage of 29.4%. Other responses: farm workers and none skills received the least responses of 5.9% and 11.8%, respectively.

Table 4.2: Type of skills NRF|SARAO need in the Karoo

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Frequency | Percent | Valid Percent | Cumulative Percent |
| Artisans and engineers | 9 | 52.9 | 52.9 | 52.9 |
| Office workers | 5 | 29.4 | 29.4 | 82.3 |
| Farm technicians | 1 | 5.9 | 5.9 | 88.2 |
| None | 2 | 11.8 | 11.8 | 100.0 |
| Total | 17 | 100.0 | 100.0 |  |

* 1. HCD programs that the NRF|SARAO is implementing in the Karoo

Respondents were aware of the programs that the NRF|SARAO is implementing in the Karoo (Table 4.3). A combined percentage of 58.8% listed artisans and engineering training programs and bursaries provisions to students, as the HCD programs being implemented by the NRF|SARAO. A significant percentage of 29.4% did not find any programs being implemented in the Karoo for HCD.

Table 4.3: HCD programs that the NRF|SARAO is implementing in the Karoo

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Frequency | Percent | Valid Percent | Cumulative Percent |
| Artisans and engineering training programmes | 5 | 29.4 | 29.4 | 29.4 |
| Bursaries for students | 5 | 29.4 | 29.4 | 58.8 |
| Cultural development and language integration | 1 | 5.9 | 5.9 | 64.7 |
| Farmers and workers awareness campaign. | 1 | 5.9 | 5.9 | 70.6 |
| None | 5 | 29.4 | 29.4 | 100.0 |
| Total | 17 | 100.0 | 100.0 |  |

* 1. Reasons skills development HCD programs were developed?

Table 4.4 summarises the responses from the participants on the reasons skills development HCD programs were developed and implemented. Most respondents indicated that the reason why the HCD programs were developed and implemented were to empower the local communities and to provide them with jobs with a combined percentage of 64.7%. Other responses that include to experience and growth to achieve growth for NRF|SARAO; make the community part of the NRF|SARAO; raise awareness in farming communities; had low percentages of 5.9% each.

Table 4.4: Reasons skills development HCD programs were developed and implemented

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Frequency | Percent | Valid Percent | Cumulative Percent |
| Create job opportunities | 5 | 29.4 | 29.4 | 29.4 |
| Empower individual from rural communities | 6 | 35.3 | 35.3 | 64.7 |
| Experience and growth to achieve growth for NRF|SARAO | 1 | 5.9 | 5.9 | 70.6 |
| For the community to be part of the project and everything is usually outsource. | 1 | 5.9 | 5.9 | 76.5 |
| Make the community part of the NRF|SARAO | 1 | 5.9 | 5.9 | 82.3 |
| Raise awareness in farming communities | 1 | 5.9 | 5.9 | 88.2 |
| None | 2 | 11.8 | 11.8 | 100.0 |
| Total | 17 | 100.0 | 100.0 |  |

* + 1. **The main beneficiaries of HCD programs**

Table 4.5 indicates the participants who are the main beneficiaries of HCD programs. Local communities had the highest percentage of 52.9% followed by learners and youths with a combined percentage of 35.3%. Some respondents however expressed deep concern over the beneficiaries of the HCD programs as the requirements often exclude other candidates who are not good in maths and sciences

Table 4.5: The main beneficiaries of HCD programs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Frequency | Percent | Valid Percent | Cumulative Percent |
| Everyone in the community | 9 | 52.9 | 52.9 | 52.9 |
| Learners and young adults. | 4 | 23.5 | 23.5 | 76.4 |
| Youth from the Karoo | 2 | 11.8 | 11.8 | 88.2 |
| Students | 1 | 5.9 | 5.9 | 94.1 |
| Young unemployed adults and school learners | 1 | 5.9 | 5.9 | 100.0 |
| Total | 17 | 100.0 | 100.0 |  |

* + 1. **How the programs work**

Table 4.6 shows the responses of the participants on how they can be involved in the programs works at NRF|SARAO. It seems that most people they apply even when they do not know what the course or program is about. This response had a high percentage of 29.4% as compared to others. Respondents also get involved through bursary applications and this had a percentage of 11.8%. The other responses that include: apply with matric results; matric, qualify and then get a bursary; none; you go for an interview before bursaries are being awarded to successful candidates; you just have to gain forty percent in each of your subject; all had the least responses of 5.9% each.

Table 4.6: How does the programs work?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Frequency | Percent | Valid Percent | Cumulative Percent |
| A program is advertised and individuals apply | 1 | 5.9 | 5.9 | 5.9 |
| Apply for the bursary | 2 | 11.8 | 11.8 | 17.7 |
| Apply even when you do not know what the course is about | 5 | 29.4 | 29.4 | 47.1 |
| Apply with matric results | 1 | 5.9 | 5.9 | 53.0 |
| By applying and filling in the forms | 1 | 5.9 | 5.9 | 58.8 |
| Community meetings and information session | 1 | 5.9 | 5.9 | 64.7 |
| Learners apply for the programs and he/she gets accepted for the program gets trained for a 4 year time spam. | 1 | 5.9 | 5.9 | 70.6 |
| Matric, Qualify and then get a bursary | 1 | 5.9 | 5.9 | 76.5 |
| None | 1 | 5.9 | 5.9 | 82.4 |
| Students and learners from the surrounding areas are put into the programmes and trained. | 1 | 5.9 | 5.9 | 88.3 |
| You go for an interview before bursaries are being awarded to successful candidates. | 1 | 5.9 | 5.9 | 94.1 |
| You just have to gain forty percent in each of your subject | 1 | 5.9 | 5.9 | 100.0 |
| Total | 17 | 100.0 | 100.0 |  |

* + 1. **How effective have these programs been in fulfilling their objectives?**

Table 4.7 describes how effective have these programs been in fulfilling community objectives. Most responses regarded the effectiveness of the programs as neither effective nor non-effective with a percentage of 35.3%. This was followed by respondents who regarded the programs as very effective (29.4%); very ineffective (17.6); highly ineffective (11.8%) and highly effective (5.9%) (Fig. 4.4). The HCD program has to date, several hundred grants have been awarded to universities and students (Berry, 2020). The NRF|SARAO has also been focusing on developing skills for operations and maintenance of the MeerKAT facility. It seems the NRF|SARAO are on target to meet the capacity needs and fulfilling their objectives as also evidenced by the Artisan and Technician Training programs (Berry, 2020).

Table 4.7: Effectiveness of HCD programs in fulfilling their objectives

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Frequency | Percent | Valid Percent | Cumulative Percent |
| Highly effective | 1 | 5.9 | 5.9 | 5.9 |
| Very effective | 5 | 29.4 | 29.4 | 35.3 |
| Neither effective nor non-effective | 6 | 35.3 | 35.3 | 70.6 |
| Very ineffective | 3 | 17.6 | 17.6 | 88.3 |
| Highly ineffective | 2 | 11.8 | 11.8 | 100.0 |
| Total | 17 | 100.0 | 100.0 |  |

Figure 4.4: Effectiveness of HCD programs in fulfilling their objectives

* 1. Strengths and weaknesses of the skills development programmes

The number of weaknesses that were identified by the respondents were more than the number of strengths for the skills development programs. The responses comprised of 56.5% weaknesses and 43.5% strengths (Fig. 4.5; Table 4.8 and 4.12).

Figure 4.5: Comparison of strength and weaknesses of the skills development programmes

Table 4.8 summarises the strengths of the human capacity skills development programmes currently implemented at NRF|SARAO. All responses were fairly similar in terms of percentage response. The highest responses had a percentage of 11.8% and these were: builds up capacity skills, sharpens instincts and enhancing capacity; NRF|SARAO give more experience; bursaries from primary school; teamwork involving the community members of the Karoo; get a full bursary, travelling and exposure; and good chance of receiving permanent employment.

Table 4.8: Strengths of the HCD programmes currently implemented at NRF|SARAO

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Frequency | Percent | Valid Percent | Cumulative Percent |
| None | 1 | 5.9 | 5.9 | 5.9 |
| Builds up capacity skills, sharpens instincts and enhancing capacity | 2 | 11.8 | 11.8 | 17.7 |
| NRF|SARAO give more experience | 2 | 11.8 | 11.8 | 29.4 |
| Bursaries from primary school | 2 | 11.8 | 11.8 | 41.2 |
| Physically present and developing skills and furthering community | 1 | 5.9 | 5.9 | 47.1 |
| NRF|SARAO make sure that they appoint qualified maths, physical science teachers | 1 | 5.9 | 5.9 | 53.0 |
| Teamwork involving the community members of the Karoo | 2 | 11.8 | 11.8 | 64.7 |
| Get a full bursary, travelling and exposure | 2 | 11.8 | 11.8 | 76.5 |
| Presence of a training centre in the Karoo | 1 | 5.9 | 5.9 | 82.4 |
| The understanding of the radio frequency operations | 1 | 5.9 | 5.9 | 88.3 |
| Good chance of receiving permanent employment | 2 | 11.8 | 11.8 | 100.0 |
| Total | 17 | 100.0 | 100.0 |  |

The weaknesses that were identified in this study mainly had to do with how the NRF|SARAO implements its HCD programs which have certain requirements and conditions that are discriminatory to potential candidates who often then end up disregarding the programs. The weakness which had the highest frequency from the respondents was that there is no guarantee that the NRF|SARAO will employ them after the program and had a percentage of 17.6% followed by the high unemployment rate regardless of good qualifications which contributed 11.8% to the responses. Candidates also fail their courses as described by the respondents together with other weaknesses as described in Table 4.9 which each contributed 5.9%. One respondent said the HCD program is not effective at all because students fail and lose their bursaries. Losing of bursaries is standard practice in bursary programmes globally, except under certain acceptable conditions. This should be clearly communicated to candidates who wish to take HCD bursaries so that they understand the reparations of not working hard for the opportunity given to them. It should however be noted that if a student fails they lose their bursary, and if they pass again, they will have their bursaries re-instated.

Table 4.9: Weaknesses of the HCD programmes currently implemented at NRF|SARAO

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Frequency | Percent | Valid Percent | Cumulative Percent |
| Lack of diversity in the programs | 2 | 11.8 | 11.8 | 11.8 |
| Students that fail lose their bursaries | 1 | 5.9 | 5.9 | 17.7 |
| Unemployment rate is high, not enough personal with good qualifications | 2 | 11.8 | 11.8 | 29.4 |
| Language barrier and human factor | 1 | 5.9 | 5.9 | 35.3 |
| Success rate at the end of the programme are enormously low | 1 | 5.9 | 5.9 | 41.2 |
| There is no guarantee that NRF|SARAO will employ you | 3 | 17.6 | 17.6 | 58.9 |
| Farm workers lost their jobs and habitats | 1 | 5.9 | 5.9 | 64.7 |
| Lack of equipment in their facilities | 1 | 5.9 | 5.9 | 70.6 |
| Lack of information being shared. | 1 | 5.9 | 5.9 | 76.5 |
| The age restriction on the program. | 1 | 5.9 | 5.9 | 82.4 |
| The selection criteria | 1 | 5.9 | 5.9 | 88.3 |
| They have a very small success rate | 1 | 5.9 | 5.9 | 94.2 |
| They do not give you the full theoretical training. | 1 | 5.9 | 5.9 | 100.0 |
| Total | 17 | 100.0 | 100.0 |  |

* 1. Factors that have hindered the effectiveness of these programs

Owing to the weaknesses of the HCD programmes currently implemented at NRF|SARAO, Table 4.10 summarises the factors that have hindered the effectiveness of these programs. Among the responses, was the fact that the NRF|SARAO does not put the Karoo personal first which had a percentage of 29.4% followed by no access to information with a percentage of 23.5%. Other responses each contributed 5.9%.

Table 4.10: Factors that have hindered the effectiveness of these programs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Frequency | Percent | Valid Percent | Cumulative Percent |
| No access to information | 3 | 17.6 | 17.6 | 17.6 |
| Access to information | 1 | 5.9 | 5.9 | 23.5 |
| Student does not feel welcome | 1 | 5.9 | 5.9 | 29.4 |
| Financial constraints | 1 | 5.9 | 5.9 | 35.2 |
| No Exposure to workshop environment, practice on equipment. | 1 | 5.9 | 5.9 | 41.1 |
| None | 1 | 5.9 | 5.9 | 47.0 |
| Poor selection Criteria | 1 | 5.9 | 5.9 | 52.9 |
| NRF|SARAO not putting the Karoo personal first | 4 | 23.5 | 23.5 | 76.4 |
| No job guarantee after completion of the programs | 1 | 5.9 | 5.9 | 82.3 |
| The equipment that they have is not enough | 1 | 5.9 | 5.9 | 88.2 |
| Too much academic focus, it should be passion and ambition. | 1 | 5.9 | 5.9 | 94.1 |
| Unemployment and access to information. | 1 | 5.9 | 5.9 | 100.0 |
| Total | 17 | 100.0 | 100.0 |  |

* 1. What the NRF|SARAO can implement to develop skills

Table 4.11 shows a review on what kind of programs NRF|SARAO can implement to develop skills. The respondents suggested that the NRF|SARAO should create more job opportunities and to provide courses for everyone that include hairdressing, cooking, baking, nails and beauty which are not directly related to the SKA project. These two responses contributed to 58.8% of the total responses.

Table 4.11: What the NRF|SARAO can implement to develop skills

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Frequency | Percent | Valid Percent | Cumulative Percent |
| Creating more job opportunities | 5 | 29.4 | 29.4 | 29.4 |
| Develop roads, buildings and other infrastructure | 1 | 5.9 | 5.9 | 35.3 |
| Do not bring maths teachers from other towns | 1 | 5.9 | 5.9 | 41.2 |
| Early skills training before studies | 1 | 5.9 | 5.9 | 47.0 |
| Online training and computer literacy | 1 | 5.9 | 5.9 | 52.9 |
| Provide courses for everyone to include hairdressing, cooking, baking, nails and beauty etc. | 5 | 29.4 | 29.4 | 82.3 |
| Sports and agriculture | 1 | 5.9 | 5.9 | 88.2 |
| Train farmers and workers the latest astronomy development | 1 | 5.9 | 5.9 | 94.1 |
| None | 1 | 5.9 | 5.9 | 100.0 |
| Total | 17 | 100.0 | 100.0 |  |

1. Conclusion

This study revealed that the respondents were aware of the HCD programs that the NRF|SARAO is implementing in the Karoo. These include: primary and highs cool bursaries, undergraduate and graduate bursaries, and artisan training which potentially benefits mostly the youth of the Karoo. Respondents had varying responses with regards to the effectiveness of the programs with most (35.3%) respondents regarding the programs as neither effective nor non-effective. With regards to the strengths and weaknesses of the programs being offered by the NRF|SARAO the percentage of weaknesses (56.5%) was higher than that of strengths (43.5%). The weaknesses mainly had to do with the way in which the NRF|SARAO programs are being implemented which are discriminatory to potential candidates and most people end up disregarding the programs. The weakness to strength ratio of programs offered by the NRF|SARAO should be very low with strengths dominating more than the weaknesses. The NRF|SARAO should look at these weaknesses and try to address them and reaching out to its staff to promote HCD which has long term benefits for the SKA project. The strengths should also be assessed so that the effectiveness of their programs continues to be enhanced.

Various hindrances that derail the progress of the programs and their successes were raised and these have to do with both the respondents themselves and their perceptions, as well as the standards that are set by the NRF|SARAO which at times hinder the potential candidates to take up the programs. Of concern is the shortage of experienced employees and vacancies remain unfilled due the continuing lack of skills retention and transfer programmes. The lack of skills retention and transfer programmes is likely to persist and affect the technology sector regardless of the call by government authorities to introduce curriculum changes in schools and tertiary institutions towards industrial demands to prevent the shortage of essential skills being experienced. Finally, the NRF|SARAO should expand its flexibility with regards to taking candidates from the Karoo for skills development programs so as to nurture and retain talented young men and women with the skills necessary for projects such as the SKA being spearheaded by the NRF|SARAO. This will aid in developing South Africa and subsequent decrease in poverty and associated crime activities that are currently alarming as reported by the SAPS.

Although useful information was presented in this study, some limitations are also associated with this study which can be addressed in future studies. The study was based on a small sample size from the NRF|SARAO and thus, the results may only be relevant to the NRF|SARAO and other technology related companies. Nonetheless, results from this study can be generalised for any organisation with an aim of supporting HCD programs for human skills, organisational and ultimately national development. The SKA project is yet to be fully operational, findings from this study might change dramatically over a longer period of time as the NRF|SARAO potentially can support more employees, grants and bursaries with time. On this regard, a longitudinal study in different settings may provide a more complete set of insights.

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1. References
2. Berry, S.T. (2021). The SKA Approach to Sustainable Research. In: H.P. Beck, P. Charitos (eds). The Economics of Big Science. Science Policy Reports. Springer, Cham: 25-31. https://doi.org/10.1007/978-3-030-52391-6\_4.
3. Binneman, A., and Corné, D. (2020). Star stories: using indigenous knowledge for stakeholder engagement. Communitas, 25: 1-17. https://dx.doi.org/10.18820/24150525/comm.v25.1.
4. Binneman, A., and Davies, C. (2021). From management to engagement: How South Africa’s Square Kilometer Array project transformed its interactions with stakeholder groups. In: A.P. Kaminski (ed). Space Science and Public Engagement 21st Century Perspectives and Opportunities. Elsevier, Amsterdam, Netherlands: 221-244.
5. Brunello, G., and Wruuck, P. (2021). Skill shortages and skill mismatch: A review of the literature. Journal of Economic Surveys, 35: 1145-1167.
6. Business Tech. (2022). Shortage of skilled workers a major risk in South Africa. Available online: https://businesstech.co.za/news/business/551336/shortage-of-skilled-workers-a-major-risk-in-south-africa/ (Accessed 03/10/2022).
7. Chinigò, D., and Walker, C. (2020). Science, astronomy, and sacrifice zones: development trade-offs, and the Square Kilometre Array (SKA) radio telescope project in South Africa. Social Dynamics, 46(3): 391-413. doi: 10.1080/02533952.2020.1850626.
8. Department of Science and Technology. (2014). Declaration of the Karoo Central Astronomy Advantage Areas in terms of the Astronomy Geographic Advantage Act, 2007. Notice 141 of 2014’, Government Gazette. Pretoria, 28 February 2014.
9. Isaacs, L. (2016). MeerKAT stands tall for tall for local science. Cape Times. 17 July 2016.
10. Khan, M.H.-U.-Z., and Khan, M.R. (2010) Human capital disclosure practices of top Bangladeshi Companies. Journal of Human Resource Costing and Accounting, 14(4): 329-349.
11. Lassey, G.A. (2002). The gloom behind the glitter of Ghana mining: community rights and the Tarkwa experience. Third world network. Africa, 101.
12. Machika, D.M. (2014). Capacity building programmes for the skills development of employees at the Gauteng department of education. MA Thesis, North-West University, South Africa.
13. Madebwe, C., Madebwe, V., and Mavusa, S. (2011). Involuntary displacement and resettlement to make way for diamond mining: the case of Chiadzwa villagers in Marange, Zimbabwe. Journal of Research in Peace, Gender and Development, 1(10): 292-301.
14. Mateus, A.D., Allen-IIe, C., and Iwu, C.G. (2014). Skills shortage in South Africa: Interrogating the Repertoire of Discussions. Mediterranean Journal of Social Science, 5(6): 63-73.
15. Mensah, S.O., and Okyere, S.A. (2014). Mining, environment and community conflicts: A study of company-community conflicts over gold mining in the Obuasi Municipality of Ghana. Journal of Sustainable Development Studies,5(1): 64-99.
16. SKA South Africa. (2015). Land acquisition programme information brochure. Available online: http://www.ska.ac.za/wp-content/uploads/2016/06/lap\_brochure.pdf (Accessed 25/08/2022).
17. SKA South Africa. (2016). MeerKAT radio telescope. Available online: http://www.ska.ac.za/science-engineering/meerkat/ (Accessed 25/08/2022).
18. Terminski, B. (2012). Development-induced displacement and human security: a very short introduction. Geneva. Available online: https://nbn-resolving.org/urn:nbn:de:0168-ssoar-359788 (Accessed 25/08/2022).
19. Utete, R. (2021). Capacity building as a strategic tool for employment equity implementation in the financial sector. SA Journal of Human Resource Management, 19:1- 10. https://doi.org/10.4102/sajhrm.v19i0.1532.
20. van der Hoef, M. (2017). The local, the global, and the self: An ethnographic account of a community Computer Centre in Carnarvon, Northern Cape, and its significance for its users’ sense of self and their place in the world. MA Thesis, Stellenbosch University, South Africa.
21. van Rensburg, R.J. (2020). The talent shortages in the South African labour market. Available online: https://solidariteit.co.za/en/the-talent-shortages-in-the-south-african-labour-market/ (Accessed 03/10/2022).
22. Wild, S. (2016). Giant SKA telescope rattles South African community. Nature. Available online: http://www.nature.com/news/giant-ska-telescope-rattles-south-african-community-1.20129 (Accessed 22/08/2022).
23. World Commission on Dams. (2000). Dams and Development. London: Earthscan Publications.